Environmental Monitoring

Project title: A Remote Sensing and GIS-Based Model of Habitat as a Predictor of Biodiversity

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Objective: The major objectives of the research were to 1) quantify the spatial and temporal variability in montane meadows; 2) develop a spectrally-based spatially-explicit model for predicting plant and animal (butterflies and birds) species diversity patterns in montane meadows; and 3) test the spectrally-based spatially explicit model developed in Objective 2 for predicting plant and animal species diversity patterns in montane meadows.

Findings: We sampled birds, butterflies, and plants for four years (1997-2000) in two regions of the Greater Yellowstone ecosystem: the Gallatin National Forest and northwestern portion of Yellowstone National Park and Grand Teton National Park. We used satellite imagery to classify two types of wetland meadows and four sagebrush communities. In Grand Teton National Park, our overall accuracy of mapping sagebrush communities was 65 percent, and highest for the mixed big sagebrush/low sagebrush community at 86 percent. Abundance of habitat specialist bird species was highly correlated with both meadow type and landscape variables. Butterfly species abundance and distribution was even more strongly correlated with meadow type (butterfly distribution was used to predict meadow type with a 92-96 percent accuracy in the Tetons). Voucher plants are housed at the University of Kansas McGregor Herbarium; voucher butterflies are housed at Iowa State University.

Project title: Chloride Flux Monitoring

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Objective: To provide a baseline for chloride flux exiting the park.

Findings: Chloride flux, a surrogate for heat flow, was determined for the four rivers draining Yellowstone National Park for the water years 1983 through 2000, with the exception of 1995 and 1996. The chloride that is emitted by the geothermal system underlying Yellowstone is designated "thermal chloride" and constitutes 93 percent of the total chloride exiting the park.

The Fall, Madison, Snake, and Yellowstone Rivers have been estimated to discharge 93 percent of the chloride leaving the Park, the remainder exits along the west boundary into the Henry's Fork River. The sum of the annual chloride fluxes for the four rivers varies as much as 20 percent year to year. This sum, when corrected for the climatic factors that influence this flux, shows a decline of 14 percent (0.8 percent a year) over the past 17 years. A similar decline in thermal chloride flux output from Mammoth Hot Springs has also been noted, as has a lengthening in the period of eruption of Old Faithful Geyser. We believe that these changes are related to the deflation of the Yellowstone caldera documented by changes in the ground levels surrounding Yellowstone Lake. The chloride flux for each river varied seasonally and annually and is postulated to depend primarily on the flow of hot springs. This flow, in turn, depends on the height of the local water table, which rises during spring runoff, and varies annually in synchronism with changes in precipitation.

Project title: Trace Element Content of Cervid Antlers

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Objective: I am studying the strontium isotopic composition and content of strontium and other trace elements in elk and deer antlers from selected national parks in the western U.S., including Yellowstone. The study will add to the general body of knowledge about the cycling of trace elements through the environment and increase our understanding of the biogeochemistry of strontium. The study will provide baseline data from which future changes may be gauged. (A copy of the research proposal submitted to the Green Educational Foundation is on file in the Division of Research, Yellowstone Center for Resources, Mammoth Hot Springs, Yellowstone National Park. Said proposal provides a detailed description, etc. of this project.)

Findings: No significant findings to date with respect to trace-element contents inasmuch as no analytical data are yet available. Evidence of antler-chewing/osteophagia by Yellowstone elk has been obtained, and this is likely related to the major- and/or trace-element content of the antlers/bones and the nutritional status of the elk. Fieldwork by me in the park in late September and early October 2000 was directed primarily toward determining the geographic distribution and frequency of occurrence of antler-chewing/osteophagic behavior through field observations of skeletal remains of dead animals and cast (shed) elk antlers in Yellowstone's northern range.

Project title: Hydrogeomorphic Approach to the Assessment of Wetlands in YNP

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Additional investigator(s): Marcus Miller, Bob Leinard, Forrest Berg

Objective: Collect data in four slope wetlands in the Lamar Valley of Yellowstone National Park. This data would be added to an existing database from sites in Montana. We hope to collect data in the park for reference purposes due to lack of human disturbance and the probability that the wetlands will remain in an undisturbed condition.

Findings: We were unable to begin fieldwork this past year due budget cuts. We have received funds to continue the work in 2001.

Project title: Inventory of Wyoming Resources

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Objective: To collect information on the condition of forest ecosystems, estimate baseline (current) conditions and trends, and detect changes from those baselines and trends over time at the state and national level.

Findings: The Inventory of Wyoming Resources began in 1997 with installation of the ground locations. The installation was completed that same year and approximately 1/3 of the locations are re-measured each year thereafter. This project has no conclusion; therefore, there is no project ending date. As of 2000, the frequency of re-measurement and total number of locations has changed. To comply with the Farm Bill, our frequency of revising the plots is now on a five-year cycle. However, the total number of plots visited in a single year (panel) was to remain unchanged. This has resulted in our adding plots to each of the existing four panels, and in 2003, adding a complete new panel. The net increase in the design will eventually result in 2/3 more locations.